Insights

A publication of the Ontario Forest Research Institute

Research shows eastern Ontario's forests are springing back from ice damage

By Abigail M. Obenchain

In early January 1998, a massive ice storm struck eastern Ontario and other parts of eastern Canada and the northeastern United States, depositing sheets of ice up to 10 centimetres thick on buildings, streets, vehicles, power lines, and trees. Forty-five people died, and millions of homes and businesses were without power, some for up to a month. Vast expanses of forest were damaged, including 600,000 hectares of hardwoods in eastern Ontario. Economically, it was the most expensive natural disaster in Canada's history, with $6.4 billion in total losses. Geographically, it was probably the largest such event to hit eastern North America since the last ice age.

The governments of Ontario and Canada took quick action after the storm to address concerns of sugarbush operators and woodlot owners in the affected areas. An aerial survey was conducted to map the damage, and preliminary guidelines for minimizing the storm's ecological and economic impacts were distributed.

Since relatively little information on ice storm damage had been published, the guidelines had to be based on results of insect-defoliation studies. As a result, staff from the Ontario Ministry of Natural Resources, the Ontario Ministry of Agriculture and Food, the Canadian Forest Service, the Eastern Ontario Model Forest, and universities came together and set up a comprehensive ice damage science program known as Ice Storm Forest Research and Technology Transfer (ISFRATT), the purpose of which was to fill the information gaps related to understanding and mitigating the effects of ice damage.

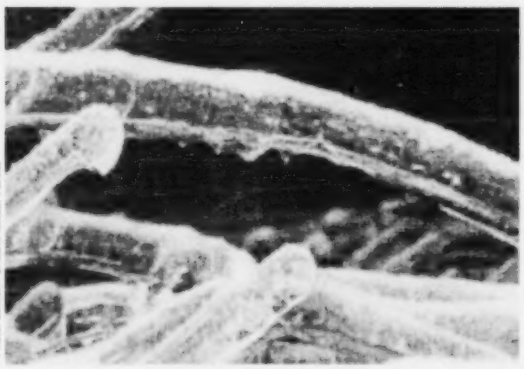

Photo: Eastern Ontario Model Forest

The great 1998 storm deposited ice up to 10 centimetres thick on 600,000 hectares of Ontario's forests.

The leaders of ISFRATT were forest biodiversity specialist Cathy Nielsen of MNR's Southern Science and Information Section and R.A. Lautenschlager, a research scientist with OFRI who is now executive director of the Atlantic Canada Conservation Data Centre in New Brunswick. Lautenschlager is very pleased with their results.

"The Ontario ice damage research effort illustrates how

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Ontario Ministry of Natural Resources
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Aussi disponible en français.

Ontario

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applied science questions associated with major environmental damage can be successfully addressed by a research team dedicated to understanding the questions of concerned client and stakeholder partners and getting answers to those questions," he says. "The answers were so client focused that when we had a major ice storm here in New Brunswick, I was asked the same questions. This time, I had answers because of the work we did in Ontario."

Results of the ice damage work have been published in special issues of *The Forestry Chronicle* in 2001 and 2003. OFRI research scientist Tom Noland, a biochemistry expert who has been looking at the effects of the damage on maple sap production, reports, "One of the most significant findings was that applying phosphorus and potassium to the soil in damaged sugar maple stands appears to help moderately to severely damaged trees recover more quickly, particularly when competing vegetation was controlled using the herbicide glyphosate. We have yet to see any visible benefits from applying lime; however, we knew from other research in maple decline areas that it could take five to seven years to get results.

"At this point we have only three years of data analyzed, and we would really like to know the longer-term effects. Fortunately, we have received additional funding from the Canadian Climate Impacts and Adaptation Research Network to help us determine the longer-term effects of fertilization, as well as the longer-term changes in sap production."

During the first round of studies, researchers confirmed that sugar maples with more than 50 percent crown damage had reduced levels of root starch, indicating physiological stress, and tended to produce less syrup. This effect lasted up to three years after the storm. "This makes sense, as the crown of the tree is the where photosynthesis and thus sugar production happens," Noland says. "If you damage or remove a significant portion of the crown, you reduce the tree's capacity to produce energy in the form of sugar.

"However, syrup production was not affected as much as you might think. Trees can be remarkably resilient. The bottom line is you don't have to worry about reduced productivity in trees with less than 50 percent crown damage. And significant mortality is not a serious issue until trees sustain damage to two thirds of their crown, which is a major stressor. If another stressor comes in, like drought or a pest outbreak, mortality becomes a serious risk."

Based on Noland's and Lautenschlager's work, it's difficult to predict how long it takes ice-damaged trees to recover fully, but it's probably in the range of three to seven years and depends on factors such as the amount of damage, tree age, and subsequent stress events.

"The older the tree, the less likely it is to recover," Noland says. "When you really have to worry is when you have an ice storm followed by drought. Eastern Ontario did have a drought in 2001, but it was long enough after the 1998 storm that it did not have a significant impact. If the climate continues to become more variable, resulting in more ice storms as well as more droughts, this could cause some serious problems for sugarbush and woodlot owners in the future."

Using data from permanent sample plots in lightly to moderately damaged hardwood stands that had been harvested six to 25 years before the storm, researchers also learned that past forest management practices had no effect on the degree of damage. However, more research is needed to determine whether recently harvested stands would experience more problems.

In red pine stands, University of Toronto researchers Krista Ryall and Sandy Smith found that ice-damaged trees were susceptible to further damage from insects, stain, and decay. They recommend that red pine plantations be maintained in young, vigorous growing condition: "Thin as needed to get good bole and height

Photo: Eastern Ontario Model Forest

The ice storm caused significant losses for sugarbush and woodlot owners, but ecologically the storm was just another natural disturbance, from which researchers have gained valuable insights.

growth, and don't allow dead and dying woody debris to build up," Smith says. "Once stand growth starts to slow down, then harvesting should be considered, as mature or declining stands will be subject to ice storm damage and bark beetle infestation. If a disturbance like an ice storm occurs, salvage operations with the intent of salvaging valuable pine material should be carried out as soon as possible."

Other studies focused on the economic impacts of the storm; changes in soil and foliar nutrients, microclimate, and near-ground vegetation that stemmed from the damage or from post-damage competition control and fertilization; and aerial mapping of the damage area.

"The fact that there were researchers from so many different disciplines involved, looking at the effects of this storm from all different angles, contributed greatly to the success of this science effort," Noland says. "We got a lot of good answers relatively quickly, but it was due to a group effort and could not have been achieved by scientists all working independently. In this case, the whole is definitely greater than the sum of the parts."

Lautenschlager attributes much of the success of this program to "communications, initiated by science transfer and communications experts, not scientists. Conducting research on private land posed significant challenges and required careful coordination and communication with landowners. Because communications experts were a driving force from the beginning and within the advisory team, results tended to focus on real questions of concern to major stakeholders. To a large degree the integration of communications among participating scientists, communications experts, and clients and stakeholders, in addition to good science, were keys to the success of the effort."

For more information on MNR's ice damage science, contact Tom Noland, (705)946-7421, tom.noland@mnr.gov.on.ca. For information on ice damage publications with OFRI authors, visit http://ofri.mnr.gov.on.ca/ofripublications.cfm, and search for ice damage. *To obtain reprints of articles with Canadian Forest Service authors, visit the CFS online bookstore at http://bookstore.cfs.nrcan.gc.ca/default.htm and do a search for* ice damage, *or contact Tony Hopkin at ahopkin@NRCan.gc.ca. The* Forestry Chronicle *special issues (Vol. 77, No. 4 and Vol. 79, No. 1) should be available at academic libraries as well.*

THE GREAT ICE STORM OF 1998:
Disaster or opportunity?

"Devastating." "Destructive." "A catastrophic event for Canadians." "A natural disaster like no other." These are all words used to describe the 1998 storm, and indeed, no other natural event has ever cost Canadians so much. What's more, the storm cut a swath of damage across hundreds of thousands of hectares of trees across several provinces. But was it an ecological disaster?

"Definitely not," says OFRI research scientist Tom Noland, who lent his biochemistry expertise to the ice damage research effort. "Strictly speaking, any natural process such as an ice storm, even if it might have had some causes that may be linked to human activities, is a part of the ecology. An ecological disaster is something such as a serious oil spill or nuclear war destroying the natural ecology. Many of the trees lightly damaged by the ice storm probably benefited from the light pruning. Even trees that were badly damaged or killed by the ice storm would be part of the process of natural selection for ensuring species fitness.

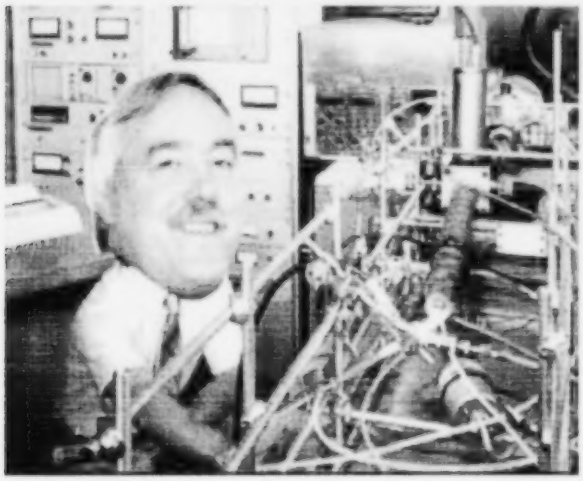
"In other words, for better or worse, ice storms are something the forest is adapted to since they are a part of the natural ecology. To me, an ecological disaster is something caused by humans."

OFRI research scientist Bill Parker, who conducted research into microclimatic changes in the damage areas, agrees. "I wouldn't refer to it as an ecological disaster, but rather as one of the most substantial natural forest disturbances that has occurred in this region of North America. The large wildfires that burned in British Columbia last summer were similar in that they were natural, if abnormally destructive, disturbances. In my mind, an ecological disaster is the Exxon Valdez oil spill or if the Asian long-horned beetle gets loose in the forest.

"Certainly, the trees that died due to severe crown loss or to a post-storm insect infestation are worse off. If you were managing a red pine plantation on your land for some future economic return, you could argue that the forest, or more precisely, the owner, was worse off. For the ecosystem as a whole, that is not the case. And for scientists, the ice storm was a golden opportunity to experience or study an unusual natural event right in our own backyard. If it happens again, we now know a lot more about what to expect and how to mitigate the impacts."

OFRI STAFF PROFILE:
Tom Noland

By Abigail M. Obenchain



One of the perks of being a tree biochemist is you get to work all over the map – literally. Tom Noland, a tree biochemistry research scientist who has worked at OFRI since April 1991, has lent his expertise to projects based in the boreal forest, in central Ontario's Great Lakes-St. Lawrence forests, and in the sugarbushes of eastern Ontario. He has worked on maple, spruce, pine, poplar, and white birch and on seeds, seedlings, and mature trees, looking at all parts of the tree, from the root to the crown. What's more, he has worked hand in hand with all types of resource professionals: silviculturists, ecologists, ecophysiologists, economists, maple syrup producers, and non-timber forest products experts.

"Variety is the spice of life," Noland says. "I do enjoy working on different types of projects as it makes my day more interesting. I am willing to take on new challenges as the opportunities present themselves as long as they relate to my area of specialization and I can contribute meaningfully."

He describes his contribution to forest research as "looking at what is happening inside the tree to make it grow and survive in its environment. In other words, I examine what is happening inside the flowers, leaves, bark, branches, and roots of the trees. I do this to try to understand how the tree reacts to the environment and what these reactions mean to the health and survival of the tree."

Noland, who has a PhD in plant sciences from the University of Arkansas, sees major advantages to working as a government scientist. "I am able to focus exclusively on research, as opposed to an academic researcher who would also be heavily involved in teaching classes. I also like the applied focus of government research. I like being able to provide clients with information that can help them solve their problems."

Some highlights of his tenure at OFRI, in addition to his ice damage research (see related article in this issue):

• ***"Glow-in-the-dark" seeds:*** He and his collaborators at OFRI developed a faster and more effective procedure to assess the viability of tree seeds, which is now being used by tree seed producers in Ontario. The procedure involves applying a glow-producing chemical called fluorescein diacetate to tree seed embryos, looking at the stained embryos in a dark room under a microscope, and seeing how much they glow. The more seeds glow, the more viable they are.

• ***Competition tolerance index.*** This study was designed to help foresters determine which conifer stocktype and seedling attributes allow seedlings to perform better when growing with competing vegetation. Among the results: Certain preplant *physiological* measures (those relating to the internal functioning of the trees) can be used to forecast the performance of different black spruce and jack pine stocktypes under herbaceous competition, and certain preplant *morphological* characteristics (those relating to the trees' form and structure) can be used to do the same for jack pine and white pine stocktypes. Tenth-year data collected by Tom and his collaborators in September 2001 support the latter findings: Certain preplant morphological root characteristics, especially root collar diameter, were correlated with seedling performance after a decade of growth under herbaceous competition. "This is important because it gives field foresters an option of growing stock designed to perform better on high-competition sites in the field," Noland says.

• ***Bioindicators of Forest Sustainability:*** Noland and a large group of collaborators have been developing a Bioindicators of Forest Condition Rating (FCR) system to monitor and rate the physiological condition of Ontario's forest stands. To determine forests' physiological condition, researchers use hyperspectral sensors, which are mounted on aircraft or satellites and measure the amount of light of different wavelengths reflected from plants. To develop the FCR system, researchers compare data collected from the air with that collected on the ground at the same time (including data on leaf biochemistry, spectral reflectance, and chlorophyll fluorescence) and with historical profiles of stand condition (or health) and productivity. In Phase I of the project, completed in 2000, Tom and his colleagues developed an FCR system for sugar maple that identified two early indicators of stress in sugar maple stands: chlorophyll concentration and chlorophyll fluorescence. In Phase II, initiated in 2000, they are expanding the scope of the project by developing an FCR system for four boreal forest species: jack pine, poplar, black spruce, and white birch.

In addition to having a myriad of research interests, Noland is an avid vegetable, fruit, and flower gardener, with woodland wildflowers as his specialty. In winter, he devotes much of his free time to cross-country sking and has shared this interest with many young people in Sault Ste. Marie as a ski instructor and coach. You can contact him at (705)946-7421, tom.noland@mnr.gov.on.ca.

What's new in Ontario's climate change research?

By Lisa J. Buse

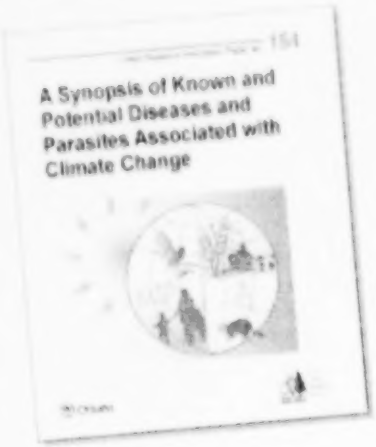
Warnings about climate change are becoming louder and more persistent, with scientists the world over making dire predictions about its effects on the environment, including forest productivity and timber supply.

Already Ontario is experiencing the effects of a changing climate. For example, in northwestern Ontario, average annual temperature has increased by 1.6°C since 1948; in the Hudson Bay Lowlands, the permafrost is melting; in the Great Lakes, water levels are decreasing; and ranges of small mammals such as squirrels and possums have marched noticeably northwards over the last two decades.

What does all this have to do with forest research? As steward of Ontario's natural resources, the Ministry of Natural Resources (MNR) has a role in determining how climate change might affect ecosystems, what can be done to mitigate the effects in the short term, and, if possible, how to adapt in the longer term. MNR staff are involved in a variety of studies to help meet these commitments.

According to OFRI research scientist Steve Colombo, what needs to happen with respect to climate change, in addition to research, is a shift in mindset. "Resource managers need to stop operating under a *constant-climate paradigm*," he says, "and start basing their management decisions on both current and future climate. For example, current timber supply models produce harvest rates based on historical forest growth and disturbance rates. Since both growth and fire occurrence are affected by climate, timber supply models should be recalibrated to account for changes that will result from future climate. We need to know how forests react to climate, when to change our management approaches on a range of issues, and on what basis these changes are being made."

This change in mindset starts with awareness that climate change is occurring and what its impacts might be, leading to mitigation or adaptation. Colombo stresses that "the challenge to resource managers is to reevaluate all their management decisions, taking into account the potential effects of climate."



Recently completed projects aimed at increasing understanding of the effects of climate change

· *A Synopsis of Known and Potential Diseases and Parasites Associated With Climate Change* (Forest Research Information Paper No. 154) describes diseases and parasites that will impact many organisms in various ecosystems throughout the province. "This report will be very useful to those looking for a broad base of information about climate change and disease," says Sylvia Greifenhagen, a forest health and pathology research forester based at OFRI and lead compiler of the report. "Among other things, it includes easy-to-follow tables that summarize the effects of climate change on animal and plant diseases and extensive climate change bibliographies."

· *Quantifying Ontario's forest carbon budgets: 1. Developing and testing a dynamic forest carbon budget model for Ontario* (Forest Research Note No. 65) reports on researchers' progress in developing a new forest growth and carbon budget model for Ontario. According to study leader Changhui Peng, former OFRI research scientist who now holds the Research Chair in Environment Modelling at the Universite du Quebec a Montreal, resource managers will be able to use this model, known as TRIPLEX, to investigate the effects of disturbances such as fire, harvesting, and insect and disease outbreaks on carbon stocks as well as to predict Ontario's forest carbon budgets to the year 2010. He has shown that TRIPLEX provides reasonable estimates of height, diameter at breast height, and stem density for jack pine stands in northern Ontario. Next steps include testing the model's ability to simulate net primary productivity, belowground biomass, and soil carbon, nitrogen, and water dynamics for various forest ecosystems in Ontario and developing modules for TRIPLEX that simulate the effects of carbon dioxide fertilization and disturbance on forest growth and carbon dynamics.

A companion report, *Simulating forest growth and carbon dynamics of the Lake Abitibi Model Forest in northeastern Ontario* (Forest Research Report No. 163), outlines the use of this model to determine carbon budgets for the Lake Abitibi Model Forest in northeastern Ontario.

Recently completed projects aimed at mitigating the effects of climate change

· *Seed source selection of eastern white pine* (Forest Research Note No. 64) presents results of a genecology study that investigated how well white pine grown from seed from this species' range in eastern Ontario would grow if planted in other areas. Researchers also subjected shoot and needle tissues from seedlings grown from these seed sources to extreme conditions simulated in a growth chamber to test how well they tolerated frost damage. Among their findings: Overall, seed from more southerly and warmer areas grew faster; thus, moving a seed source 1 degree north in latitude could increase height growth significantly in the first

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five years (in turn increasing forest productivity and carbon sequestration). However, OFRI research geneticist Pengxin Lu reports that moving seed too far north increases the risk of frost damage, as the seedlings may break bud and start growing before the frost-free date. Among his recommendations: To prevent reductions in growth, avoid using seed collected north of the planting area; to get increased growth with minimal risk of frost damage, use seed from 1.5 to 2 degrees south of the planting area. These results may be particularly relevant to forest managers who are considering moving seed sources north to help offset future increases in temperature due to global warming.

- Do *nutrient-loaded* black spruce seedlings sequester more carbon? According to research results presented in *Increasing carbon sequestration through enhanced stand establishment practice: Nursery nutrient loading* (OFRI Forest Research Report No. 161), black spruce plantations regenerated using nutrient-loaded seedlings could sequester almost 32 percent more carbon than those regenerated from conventional seedlings. Researchers also found that six years after planting, nutrient-loaded seedlings had greater height growth and biomass production than conventional seedlings and that the effect of nutrient loading on growth was similar to if not greater than the effect of applying herbicides to control competitive vegetation. A relatively new fertilization technique, nutrient loading involves enriching or "loading" seedlings with nutrients during nursery culture. Nutrient-loaded seedlings receive exponentially increasing doses of fertilizer to match seedling growth and to ensure that the concentration of nutrients inside the trees remains constant over time. This ensures that seedlings have adequate nutrient reserves to rely on after planting and appears to be a cost-effective means for ensuring the trees can compete with other vegetation.

New forest research projects aimed at increasing understanding of the effects of climate change

- *Improving the Modelling of Ontario's Forest Carbon Budget.* This project builds on the work by Changhui Peng described above. Researchers will produce an estimate of the amount of forest carbon using the Canadian carbon budget model (CBM-CFS2). This model predicts the amount of carbon in trees, soil, and organic litter and can be used to predict the effects of alternative forest management scenarios on carbon storage for each of the province's management units and the province as a whole. According to project leader Steve Colombo, "in addition to supporting Canada's obligations under the Kyoto Protocol, carbon budget modelling helps us to monitor changes in forest productivity. Carbon-rich forests are usually more productive."

- *Exploring the Vulnerability of Ontario Forests to Shifting Ranges of Tree Diseases Due to Climatic Change.* Through climate-dependent, spatially explicit models, researchers will map future potential ranges of selected tree diseases and use these maps to predict how the ranges of selected forest tree diseases could shift under climate change. These predictions will be reviewed in light of possible interventions that might offset the effects of these diseases on forest ecosystems.

New forest research projects aimed at adapting forests to climate change

OFRI research scientist Tom Noland and biochemical lab technologist Maara Packalen are working on a project that could support climate change adaptation efforts. Working with researchers at Dalhousie University and the Canadian Forest Service in New Brunswick, they are identifying black spruce that grow well despite heat and drought stress and therefore may grow better under a changing climate.

Photo: Rudy Viuhinen

OFRI biochemical lab technologist Maara Packalen prepares to separate and analyze black spruce proteins for use in identifying the presence or absence of specific traits, including heat and drought resistance.

Specifically, they are studying *protein markers* that can be extracted and isolated using special biochemical techniques. Proteins are large molecules that are composed of a sequence of amino acids whose order is determined by DNA coding; they are required for the structure, function, and regulation of cells, tissues, and organs. Since each protein has unique functions and is slightly different, they can be used as markers to identify presence or absence of specific traits, in this case heat and drought resistance in a tree species. According to Noland, "Most potential marker proteins can be extracted only from the stress-tolerant trees so resistant families can be quickly identified."

Although it will be a few years before they've perfected the technique, it holds promise for identifying families of black spruce that could be planted to maintain our current wood supply despite future climatic change.

For more information about MNR's climate change work, contact MNR's climate change coordinator, Paul Gray, (705)755-1967, paul.gray@mnr.gov.on.ca. To view and download Ontario publications related to climate change, visit http://www.ene.gov.on.ca/envision/air/climatechange/index.htm.

For information about OFRI's climate change projects, visit http://ofri.mnr.gov.on.ca and click on Research *and then* Climate Change, *or contact the researchers mentioned in the article. To obtain copies of OFRI's climate change-related publications, call the OFRI publication request line at (705)946-2981, ext. 271, or e-mail information.ofri@mnr.gov.on.ca.*

Advances in propagating jack pine and white pine using rooted cuttings

By Lisa J. Buse

What makes an ideal planting stock? Most foresters would cite faster growth, increased disease resistance, and improved wood quality, all traits often associated with trees/stock grown from seed produced at seed orchards or tree improvement areas. However, developing improved stock can take years; thus, when trees with desired traits are available, the trick is to figure out ways to expedite the propagation process to produce adequate stock to supply planting programs.

Rooted cuttings offer enormous potential for increasing forest productivity and value. In many parts of the world, intensively managed forest plantations established with rooted cuttings are producing commercial timber. In Ontario, reliable, cost-effective, rooted cutting systems have yet to be developed for most boreal forest crop species. OFRI's forest genetics program is hoping to change that, at least for pine species. According to research geneticist Pengxin Lu, "Having a better understanding of the environmental parameters that influence the rooting process will help to increase rooting success, which in turn will lower rooted cutting production costs and make this type of stock more feasible for planting programs."

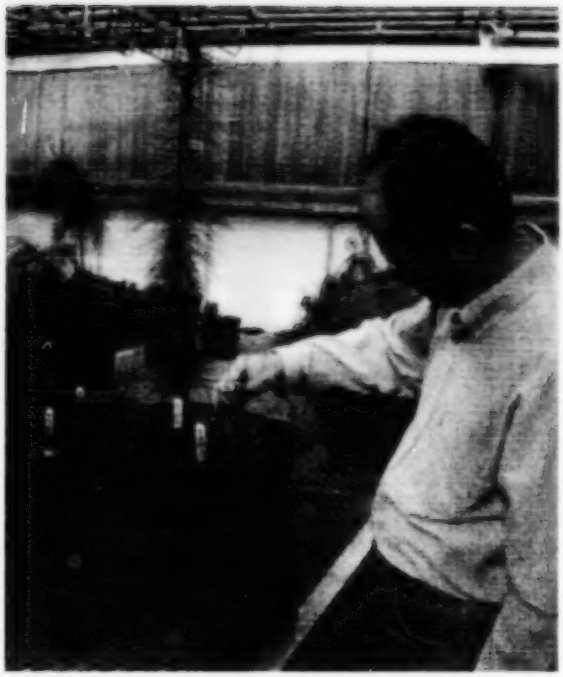

Photo: Trudy Vaittinen

OFRI research geneticist Pengxin Lu is working on improving jack and white pine rooting success using proliferated dwarf shoots (PDS). He hopes this work will lead to an effective, cost-efficient means of mass-reproducing pine seedlings with desired traits.

What are cuttings?

Cuttings are pieces of living plant tissue taken from a donor tree and then planted to produce a new tree. Cutting types are named based on the point where the cutting is taken from the donor: There are stem cuttings, leaf cuttings, leaf-bud cuttings, and root cuttings. Root cuttings, the most common type used in forestry propagation of broad-leaved trees such as aspen, are taken from young trees during winter and spring to maximize root starch reserves and increase the likelihood that the root cuttings will sprout shoots. With conifer species, cuttings are usually shoot segments bearing terminal buds.

Why use rooted cuttings?

When you look at a plantation of jack pine, you will see differences among the trees due to *phenotypic variation*, resulting from the interaction between genetics and environment. Tree improvement results indicate that 15 to 25 percent of the phenotypic variation in a jack pine plantation is attributable to the genetic component, that is, the proportion of a parent's genetic traits that are passed onto its offspring. Tree improvement efforts can influence that proportion of the tree's characteristics. However, even when both parent trees are identified as being *superior* (having certain desired traits), the offspring may not inherit those traits because of random genetic recombination during mating or the gene scrambling that occurs during sexual reproduction. A rooted cutting contains the same genetic material as the tree it came from; thus, all the superior traits are retained, although sometimes they may not be expressed in the new tree.

Although more expensive to produce than conventional seedlings, cuttings are advantageous when seed supply is limited or operational quantities of improved stock need to be produced quickly, for example, to provide disease-resistant stock. The Ontario Ministry of Natural Resources has tried vegetative propagation of conifer seedlings before; small-scale rooting trials of black and white spruce initiated by Marie Rauter, former Ontario Department of Lands and Forests research scientist, at Maple in 1968 were expanded to Orono nursery in 1973. In the 1980s, spruce and larch were operationally rooted at the Moonbeam Clonal Forestry Centre near Kapuskasing, Ontario. According to OFRI research scientist Steve Colombo, this program was discontinued because the genetic gains achieved were not cost effective.

OFRI's rooted cutting research

Some conifer species are difficult to propagate via cuttings. Historically, jack pine has been thought to be especially difficult to propagate vegetatively. In the 1990s, a group at the Agri-Food Canada-Morden Research Centre in Manitoba developed an approach to increase pine rooting success using proliferated dwarf shoots (PDS). In 2002, OFRI's Lu began simplifying and testing this technique with jack and

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white pine. He contends, "This method could significantly increase rooted cutting productivity and reduce operational production costs."

The goals of his pine rooted cutting project are to:

- Develop an efficient, effective, low-cost method to propagate jack pine and white pine seedlings using vegetative methods, specifically rooted cuttings
- Demonstrate that rooted cuttings can survive and grow as well as seedlings after outplanting
- Evaluate the genetic gain resulting from selecting and propagating only the top-ranking individuals from top families (based on best first-year cutting height growth)

To date, Lu and his colleagues at OFRI have successfully simplified the process involved in rooting jack pine using proliferated dwarf shoot cuttings. In support of the Intensive Forest Management Science Partnership: NEBIE Plot Network Project (see *Insights* Vol. 5, No. 2), led by OFRI's Wayne Bell, more than 7,000 jack pine rooted cuttings were produced at OFRI in 2003 using cuttings taken from superior seedlings of the best families from a seed orchard in northwestern Ontario. When planted in 2004, this test will be the first to compare the growth of jack pine rooted cuttings vs. seedlings in Ontario. The genetic gains from vegetative propagation will also be quantified.

Although the cost-effectiveness of this method still needs to be assessed relative to the potential gains, the results of this research may help resource managers to efficiently reproduce stock with preferred traits and/or high growth potential for reforestation. This work is timely given that Lu has another immediate practical use for the method: propagating blister rust-resistant white pine stock for reforestation in central Ontario. This stock will be ready for field testing in 2004.

For more information, contact Pengxin Lu at (705)946-7415, pengxin.lu@mnr.gov.on.ca.

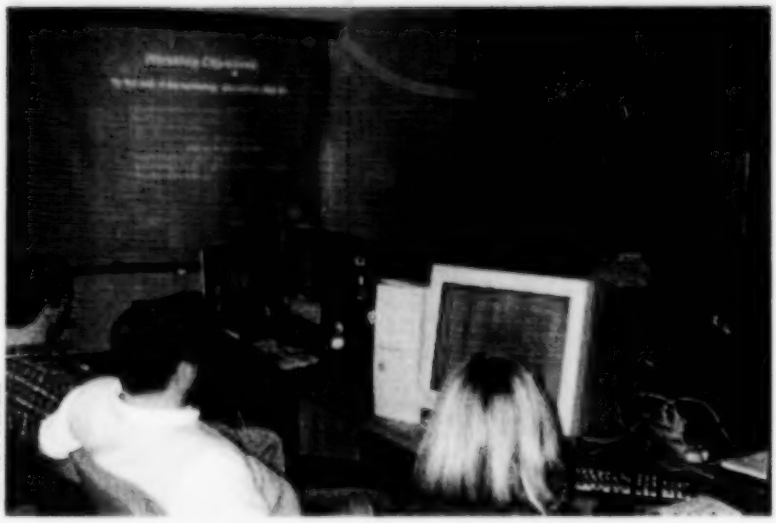


Photo: Marc Ouellette

OFRI research scientist Ajith Perera and his colleagues conduct BFOLDS user training for MNR regional specialists in March 2004 at OFRI.

New Boreal Forest Landscape Dynamics Simulator (BFOLDS) hits the desks of Ontario's forest planners

By Lisa J. Buse

How well do we understand natural forest disturbance patterns? How closely does forest management emulate these patterns? Given that Ontario's Crown Forest Sustainability Act directs forest managers to move towards emulating these patterns, these are critical questions.

We know that boreal forests are adapted to large-scale natural disturbances, such as fire and insect defoliation. To move towards emulating natural disturbance patterns, forest managers need to know how the landscapes they are managing could change over long periods under natural conditions. This information provides a benchmark against which the outcomes of forest management can be assessed.

Documented information about past disturbances is limited mostly to the last 100 years, throughout which fires were generally suppressed. Even without fire suppression, this timeframe provides relatively short-term evidence of disturbance dynamics, while landscape-scale natural processes occur over much longer time frames and vary through time. While historical data may shed light on what did happen, those patterns might not recur even if the socio-economic and climatic conditions that prevailed in the past could be recreated. In other words, what *did happen* is not necessarily indicative of what *might happen*.

The question becomes how do we determine the longer-term variation in potential disturbance patterns? OFRI's landscape ecology researchers believe that simulation models are useful tools for better understanding boreal forest disturbance regimes and assessing how closely forest management emulates these regimes.

What is BFOLDS?

BFOLDS, which stands for Boreal Forest Landscape Dynamics Simulator,

is a model developed at OFRI that simulates forest fire disturbance patterns for Canadian boreal forests. Ajith Perera, an OFRI research scientist and leader of the model development team, explains that "this spatial model can predict medium-term [several centuries] forest fire regimes and forest cover type changes over large forest regions and many millions of hectares. It effectively combines the best published science on forest fire processes and succession with Ontario spatial databases of weather, fire ignition patterns, forest species distribution, soil, and terrain. Cover type transitions are based on published knowledge of boreal forest succession [how forests change through time].

"This model predicts what fire disturbances could happen on the landscape without human intervention given present conditions," he continues. "Predictions are based on probabilities, for example, 90 percent chance of a forest area in a particular landscape getting to a certain age or 60 percent chance of an area burning. These probabilities are based on criteria such as weather; site conditions, including species age and composition; and patterns of previous burns. These many factors, acting together, will make the model outcome closer to the randomness and uncertainty that prevail in nature."

Perera and his colleagues have been developing and improving this model since 1999.

What can BFOLDS be used for?

The BFOLDS model can be used to:

- Explore and understand the nature of boreal forest fire disturbance regimes and how these vary through time and over large areas. The outcomes of disturbance result in varying forest patterns, structure, and composition, also referred to as bounds of natural variation.
- Predict future forest landscape conditions in a spatially explicit manner (linked to landbase and accounting for neighbour interactions).
- Establish benchmark values for forest disturbance regimes and forest cover changes in a quantitative, objective, defensible way. The model helps to understand the variability in natural patterns and provides a range of targets, showing tendencies and likelihood of occurrence.

In addition to increasing understanding of natural disturbance patterns, BFOLDS is being used to help resource managers in Ontario decide how much old growth the landbase can sustain and where on the landscape to plan for it. "Areas that are less likely to burn over longer periods are obvious candidates for future potential old growth forest areas," Perera notes.

What doesn't BFOLDS do?

When applying models it is important to understand their limitations to ensure appropriate use. "BFOLDS is not a decision-support tool," Perera cautions. This model:

- Is not a prescriptive user tool for automatically generating management prescriptions – it provides insight, not decisions
- Cannot be used as a tactical planning tool where predicted outcome is deterministic (always the same)
- Cannot be used for small areas (less than 100,000 hectares) or short time frames (less than 100 years), because boreal forest disturbance regimes operate at large spatial and temporal scales
- Does not forecast specifically where forest fires will occur and how forest cover will change

Who's using BFOLDS?

For the development of MNR's new landscape-scale guide for forest management, the analysis team has chosen to use BFOLDS to generate revised natural disturbance emulation guidelines. Since July 2003, several BFOLDS training workshops have been conducted for MNR's regional forest planning staff. A "train-the-trainer" session was conducted for MNR's regional specialists in March 2004, and the model will be released for use by regional planners and policy developers in April 2004. The USDA Forest Service, Alberta Forest Service, University of Waterloo, and University of Toronto are exploring the use of BFOLDS in various research projects.

What's next?

Already several journal publications and book chapters have been written on the model and its use in forest management. In addition, this model is being converted to a user-friendly planning tool. A manual for the user tool geared for MNR staff will be published this spring, with a more general version planned for release later this year. Next steps for research and development include conducting sensitivity analyses for various input databases and model parameters, as well as testing and calibrating the embedded forest succession routines.

For more information, contact Ajith Perera at (705)946-7426, ajith.perera@mnr.gov.on.ca; for associated publications, e-mail information.ofri@mnr.gov.on.ca or visit http://ofri.mnr.gov.on.ca and follow these links: Publications - Publication List 2003 - Forest Landscape Ecology.

Looking for an older OFRI publication?

If you want to know what OFRI published from 1996 to 2000, you can now find that information in one handy place on the Internet: Just visit http://ofri.mnr.gov.on.ca/ofripublications.cfm and click on *OFRI 1996-2000 Bibliography*, which will take you to a link to the PDF version of this document.

New report details "SLAM" project establishment

By Abigail M. Obenchain

Researchers with the SLAM project, known formally as *Developing Sustainable Mixedwood Practices in a Stand-Level Adaptive Management (SLAM) Framework*, have published their first report, which provides an overview of the project's establishment. "We're very pleased with our progress to date," says OFRI research forester Jim Rice, who is one of the science leads for the project. "Modified harvesting and renewal are being conducted on a large scale near Cochrane and Gogama to advance our knowledge of boreal mixedwood forest ecology and silviculture. This work is being done in an adaptive management framework, which means that we have a process in place for monitoring and evaluating outcomes of our practices and are using the information we gather to continually improve these practices.

"This report provides information on the research questions we are addressing, the project partners, the research sites, the project design, the plot layouts, the measurements being taken, data analysis, knowledge transfer, and challenges and prospects," he continues. "Field work is moving ahead as planned. Harvesting, site preparation, and planting have been completed at the study site managed by Abitibi Consolidated east of Cochrane. Harvesting and site preparation have been completed at the study site managed by Domtar south of Gogama. Planting at the Domtar site will take place in spring 2004. During the past field season, data were collected at both sites."

Results of this research will be used to help resource managers promote desirable composition, structure, quality, and growth rate of boreal mixedwood stands; improve policies and practices for enhancing economic and ecological sustainability of boreal mixedwood forests; and better understand the opportunities and challenges of active adaptive management.

Project partners are the Upper Lakes Environmental Research Network (ULERN), forest industry (Abitibi-Consolidated, Domtar), Forest Engineering Research Institute of Canada, Lake Abitibi Model Forest, Canadian Forest Service (Great Lakes Forestry Centre), and Sault College. Living Legacy Trust is a major contributor to this project.

To obtain a copy of the project establishment report (OFRI Forest Research Information Paper No. 157), call the OFRI publication request line at (705)946-2981, ext. 271, or e-mail information.ofri@mnr.gov.on.ca.

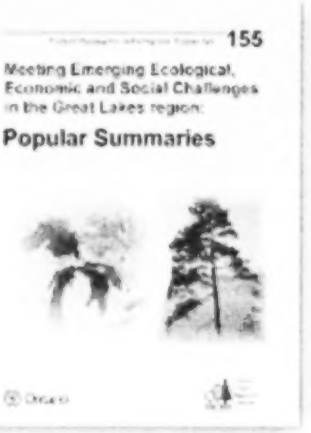
Also available: Applying crown and bole allometry to management of boreal mixedwood species, *OFRI Forest Research Report No. 162, by G.B. MacDonald and J. Elliott.*

Now available:

Popular summaries document related to June 2003 Sustainable Forest Management Summit

If you weren't able to attend the Great Lakes Forest Alliance's Second Annual Sustainable Forest Management Summit, held in June 2003 in Sault Ste. Marie, you can still learn what the concurrent and poster session presenters had to say by obtaining a copy of OFRI Forest Research Information Paper No. 155, titled *Meeting Emerging Ecological, Economic, and Social Challenges in the Great Lakes Region: Popular Summaries.*

The purpose of this summit was to provide a forum to discuss emerging forest resource issues in the Great Lakes Region, with a triple focus on ecology, economics, and sociology. More than 130 people attended, mostly from Ontario, Michigan, Wisconsin, and Minnesota, but some attendees came from as far away as Oregon. Just some of the topics covered: certification, criteria and indicators of sustainability, value-added forest products, environmental education, rural vs. urban attitudes towards forest management, climate change, riparian zone management, and maintenance of wildlife habitat.



To obtain the popular summaries document, call the OFRI request line at (705)946-2981, ext. 271, or e-mail information.ofri@mnr.gov.on.ca. Ask for FRIP No. 155. To obtain the PDF version, visit the OFRI Publications *page at http://ofri.mnr.gov.on.ca/ofripublications.cfm and follow these links:* Publication List 2003 - Miscellaneous.

New study to help forest planners predict effects of harvesting on Ontario's streams

By Abigail M. Obenchain

The Sustainable Forest Management Network (SFMN) has announced that it is funding a new three-year criteria and indicators project on the effects of disturbance on streams in Ontario's forests. According to OFRI soils research scientist Jim McLaughlin, a key goal of this study is to develop a planning tool that forest managers can use to predict how management plans will affect streamflow at varying spatial scales.

Researchers will develop this predictive ability using data from five watersheds, located near Thunder Bay, White River, Cochrane, Sault Ste. Marie, and Bracebridge, representing Ontario's major forest ecozones. Forest disturbance records at each site will be compiled in a geographic information system, enabling the mapping of disturbance type, amount, location, and spread.

These patterns will be compared with streamflow at various spatial scales to determine how harvesting has affected streamflow. In addition, computer models will be used to compare streamflow following disturbance to that in unharvested forests and to predict how streamflow will change depending on the harvesting pattern. Finally, researchers will develop criteria and indicators that can be used in streamflow monitoring and a predictive tool for forest planners to use to model the effects of a given management plan on streamflow as well as the cumulative effects of harvesting through space and time.

Photo: Sandra Wawryszyn

OFRI research scientist Jim McLaughlin collects a water sample from a stream near White River. Data collected from this and other sites will feed into a planning tool that predicts how management plans affect streamflow at various scales.

"This tool will help forest companies to meet certification requirements by giving them the ability to demonstrate that their management plans minimize impacts on water resources," McLaughlin says. "We are very pleased that there will now be a provincial network for monitoring hydrological impacts at varying scales, and we are hopeful that this project will help set the stage for a national network."

McLaughlin is leading work at the White River site, and Rob Mackereth, a scientist with MNR's Centre for Northern Forest Ecosystem Research (CNFER), is the lead for the Thunder Bay site. Other partners include Trent University, which is leading the overall project; the University of Western Ontario; the University of Guelph; and the Canadian Forest Service (Great Lakes Forestry Centre).

During the 2004 field season, researchers will continue installing monitoring equipment at the study sites to measure streamflow at various scales. The project partners are also planning a two-day workshop on forest hydrology and hydrological modelling.

For more information on this study, contact Jim McLaughlin at OFRI, (705)946-7418, jim.mclaughlin@mnr.gov.on.ca; Rob Mackereth at CNFER, (807)343-4009, rob.mackereth@mnr.gov.on.ca; or Jim Buttle at Trent University, buttle@trentu.ca. Visit the Sustainable Forest Management Network at http://sfm-1.biology.ualberta.ca.

Trivia

Can you answer these research trivia questions?

1. In southern Ontario red pine plantations that are designated to be converted to mixedwoods, did OFRI research pathologist John McLaughlin determine that Armillaria is a greater threat to pine or to hardwoods?

2. What OFRI invention, whose development was led by OFRI tree stress research scientist Steve Colombo, has been patented?

3. According to the research of OFRI ecophysiology research scientist Bill Parker, how do herbaceous and woody competition differ in how they conduct their physiological "warfare" against white pine seedlings?

Answers (upside down)

1. Pine.
2. The Stress Induced Volatile Emissions procedure, which detects seedling stress by measuring how much ethanol or acetaldehyde gas the trees are emitting.
3. Herbaceous species tend to use up soil moisture, putting white pine under drought stress, while woody species tend to outgrow and shade white pine seedlings, reducing the light they need for photosynthesis.

LLT Funds Large-Scale Photography Research Project

Could lead to improved forest and wildlife habitat inventories

By Abigail M. Obenchain

Ontario's Living Legacy Trust (LLT) has funded a one-year project to test a helicopter-mounted large-scale photography (LSP) system for its accuracy and cost effectiveness as a forest inventory and wildlife habitat assessment tool in the Great Lakes-St. Lawrence forest of Ontario.

"We believe that large-scale photography has great potential as a research and forest management tool," says Bill Cole, project science lead and a research scientist at OFRI. "LSP, which produces aerial photos with a high degree of fine detail, has been around for several decades, but using it to remeasure permanent plots wasn't practical because we didn't have precise global positioning systems to pinpoint geographic locations of plots and trees. With recent advances in GPS technology, we think now is a good time to re-evaluate LSP's potential."

According to Cole, its potential uses include:

- Seeing forest details such as tree species, understory vegetation, wildlife habitat (standing and fallen dead trees), and possibly even tree quality
- Providing more accurate estimates of tree crown sizes than traditional ground-based field measurement, leading to improved predictions of tree volume and growth
- Determining whether remaining uncut trees are properly spaced after harvest, which is important to silvicultural effectiveness monitoring
- Inventorying and monitoring ecologically sensitive sites such as protected areas or wetlands without leaving so much as a footprint
- Rapidly capturing images of the forest during a narrow window of opportunity, such as the time after the leaves fall and before the snow flies, with interpretation taking place in the lab over the winter
- Inventorying a large number of sites cost effectively, especially in inaccessible areas

Questions researchers hope to answer through this study include:

- How accurate is today's GPS technology at locating pre-defined research or monitoring plot locations, as well as the trees, other vegetation, and standing and fallen dead trees within them from, the air?
- What types of data can be collected as accurately using LSP as by sending in a field crew? Types of data that will be collected for this project include tree species, relative location of trees and tree crowns, crown diameter, standing and fallen dead trees, tree quality, and ecosite type.
- How does time of year affect data collection (what can be seen on the photos in early spring vs. mid-summer)?

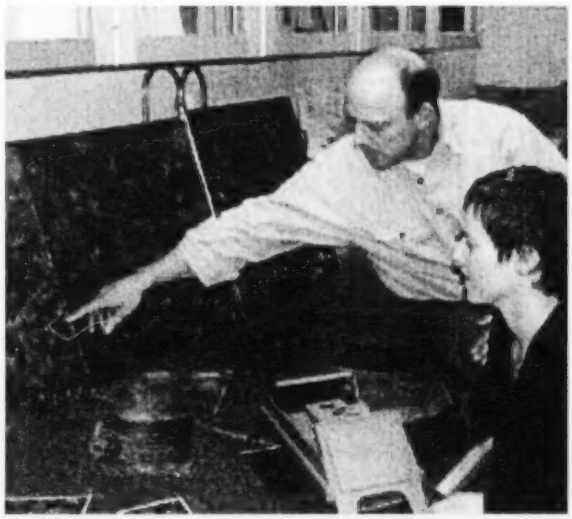


Photo: Abigail M. Obenchain

OFRI research scientists Bill Cole and Kim Chapman use a stereoscope and large-scale photographs taken from a helicopter in the spring and enlarged to different scales to determine their effectiveness for measuring Great Lakes-St. Lawrence forest plot and tree characteristics for forest inventory and wildlife habitat assessment.

Preliminary data analyses suggest that:

- The GPS-controlled camera firing system can capture stereo images about 8 metres from a pre-defined location, such as a plot centre post. This accuracy level allows reliable capture of images within a pre-defined stand but may limit the ability to capture all of a small research plot.
- Most overstory tree species can be identified in the leaf-off images, although it can be difficult to distinguish similar-looking species (e.g., sugar maple, beech, and yellow birch).
- Average stem diameter of overstory trees can be estimated at the plot level from their crown diameters; however, interpreted diameters for individual trees can be quite different from their actual diameters.

· It is much more difficult to locate and identify species and to measure crown diameters on small understory trees, especially hardwoods, than on overstory trees.

· This technology may be very useful for forest inventory and wildlife habitat assessment.

Data analysis, including economic analysis of this LSP system vs. traditional ground-based inventory, and report preparation are in progress and will be completed in 2004.

Other partners in this project are the Upper Lakes Environmental Research Network (ULERN), R&B Cormier Inc., Wisk-Air Helicopters Ltd., Canadian Forest Service (Great Lakes Forestry Centre), Tembec, Domtar, and Clergue Forest Management.

Other MNR staff involved in this project are Kim Chapman and Jeff Kokes, OFRI; Scott Jones, Jim Hayden, Peter Uhlig, John Johnson, Sean McMurray, and Deb McIlwrath, Ontario Terrestrial Assessment Program; Murray Radford and Adam Rudzki, Forest Resources Inventory; and Thom McDonough, Corrinne Nelson, and Neil Stocker, Forest Management Branch.

For more information on this project, contact Bill Cole, OFRI, (705)946-7408, bill.cole@mnr.gov.on.ca.

Go to http://ofri.mnr.gov.on.ca for quick access to information about forest research in Ontario . . .

OFRI is pleased to announce the launch of its Internet site at http://ofri.mnr.gov.on.ca. This site contains information about OFRI and its partners, research projects, accomplishments, publications, news and events, facilities, and more. In addition, the Research page (http://ofri.mnr.gov.on.ca/ofriresearch.cfm) contains links to profiles of 21 of OFRI's research projects. This site is housed within the Ontario Ministry of Natural Resources' website (http://www.mnr.gov.on.ca).

"We hope this new site will be helpful to our clients and partners," says OFRI general manager David DeYoe. "It will provide them with easy access to a range of information related to OFRI's research, from who's working in what areas to what the latest results and publications are."

For more information about the site's development or to provide feedback on the site, contact OFRI communications specialist Abby Obenchain at abigail.obenchain@mnr.gov.on.ca.

. . . And for quick access to all of MNR's research, science, and technical information, visit http://sit.mnr.gov.on.ca

This new "gateway" site provides two ways to access the Ontario Ministry of Natural Resource's research, science, and technical information:

· Through links to the MNR units involved in research, science, and technical work (OFRI, CNFER, Wildlife Research and Development, regional science and information sections, Natural Heritage Information Centre, Land Information Ontario, Forest Resources Inventory, Ontario Parks Science and Research, and more)

· Through links to subject pages that focus on research, science, and technical information related to *Forests, Fish, Wildlife, Aquatics, Parks and Protected Areas/ Natural Heritage*, and *Landbase*

For more information about this gateway page, contact sit@mnr.gov.on.ca.

Including wetlands in carbon budget modelling

By Abigail M. Obenchain

You might be surprised to learn that nearly one third of Ontario's landbase is covered by wetlands, most of which are *peatlands* (wetlands with peat depth of at least 40 cm). These areas may sequester or store significant amounts of carbon, making them an important component of carbon budget calculations. A new OFRI report titled *Carbon Assessment in Boreal Wetlands of Ontario* provides modellers, policymakers, and others interested in climate change with a useful review of existing information on how carbon cycles through Ontario's peatlands over various time periods and spatial scales.

"This report focuses on the interactions among peatland plants, hydrology, and carbon cycling and budgets at local and regional scales in boreal Ontario," says Jim McLaughlin, an OFRI research scientist and author of the report. "It complements several other excellent reviews of wetland carbon cycling published over the last decade. It also presents research now underway to improve the ability to assess carbon in Ontario's peatlands and identifies critical research gaps. The information

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presented can be used to help define the role of Ontario's peatlands in national and global carbon cycles and budgets."

Information in the report, which was funded by MNR's Climate Change Program, includes:

- Descriptions of Canada's and Ontario's wetland regions/types and uncertainties in global estimates of wetland extent
- Discussions of carbon cycling in boreal peatlands, including net primary production and litter decomposition, peat accumulation and carbon sequestration, carbon storage and dynamics, importance of peatlands to atmospheric loading of methane and carbon dioxide, and effects of climate change on peatland carbon cycling
- Different approaches to scaling peatland carbon to landscape, regional, and global levels
- Summaries of the information gaps and recommendations for future peatland carbon work

McLaughlin points out that even with this information in hand, carbon modellers are going to have a tough time modelling peatland carbon cycling. "Clearly, all wetlands are not the same. Carbon cycling varies dramatically among peatland types and is affected by season and climatic variation. This is going to have a big impact on our ability to quantify peatland carbon cycles."

Another concern for modellers and policymakers is the fact that as the climate changes, wetlands in some parts of the province could start to dry up, resulting in ecological changes that quickly transform these areas from carbon sinks to carbon sources.

For more information on this project, contact Jim McLaughlin at OFRI, (705)946-7418, jim.mclaughlin@mnr.gov.on.ca. To obtain a copy of Carbon assessment in boreal wetlands of Ontario *(OFRI Forest Research Information Paper No. 158), call the OFRI request line at (705)946-2981, ext. 271 or e-mail information.ofri@mnr.gov.on.ca.*

Do cancer drugs grow on trees?

By Abigail M. Obenchain

If a new three-year research project goes according to plan, farmers in northern Ontario may be able to grow Canada yew as a highly profitable cash crop, says OFRI research scientist Tom Noland, science lead for the project.

"Canada yew is a shrub that produces a cancer-inhibiting chemical called *paclitaxel*," he explains. "Paclitaxel is used to make Taxol, the best-selling chemotherapy drug in the world, with nearly $1 billion U.S. in annual sales worldwide.

"Through this project, we hope to find and cultivate 'elite' yew material that grows quickly and has the highest possible paclitaxel concentration. We also hope to determine the best management practices for establishing and growing Canada yew in northern Ontario plantations, including the best time to harvest."

Paclitaxel was first isolated in Pacific yew bark in the early 1960s in the state of Washington. Human trials of the drug Taxol occurred during the 1980s, and it was approved for use in treating ovarian, breast, lung, and other cancers during the early 1990s. However, it takes a lot of Pacific yew bark to make a small amount of Taxol, so researchers refocused their efforts on trying to synthesize the drug, a difficult and expensive task, and on finding alternate sources for paclitaxel.

"Canada yew has significant concentrations of this chemical in its bark and leaves," Noland says. "So rather than killing the entire plant to get paclitaxel out of the bark, which is the case with Pacific yew, we hope to develop ways to harvest the ends of Canada yew branches from hedges growing in a farm setting. Basically, the farmer would give the yew a good haircut every other year to produce a valuable crop of yew biomass."

Ironically, in the past some foresters probably viewed Canada yew as an understory weed to be be eradicated, Noland reports. "It's not valuable for wood products the way Pacific yew is – it's a sprawly shrub rather than a tree. It is also highly toxic to humans, horses, and cattle, although it's a preferred winter food source for moose and deer, and many birds eat its fruit, which is nontoxic. Canada yew has also been used for years as an ornamental evergreen shrub for landscaping homes.

"The fact that this rather humble plant could help save countless lives underscores the need to sustain all plant species, not just ones that have known economic or aesthetic value. There are many plants out there whose lifesaving properties have yet to be discovered."

The Northern Ontario Heritage Fund Corporation (NOHFC) is providing $117,750 for the Canada yew project, while FEDNOR (Federal Economic Development Initiative for Northern Ontario) is considering a related funding proposal. NOHFC chair Rick Bartolucci says he sees this project as an important step in helping to ensure the sustainability of northern Ontario's family farms and to diversify the economy of the area.

According to Noland, the first steps in the project will include collecting yew plants from forests between North Bay and Wawa this spring; propagating these plants at the Thessalon First Nation bio-centre this summer; and outplanting at three sites – the OFRI Arboretum near the Sault, the biocentre, and the land of Thessalon farmer Brian Whelan – this fall. The yew will be planted on two different soil types and at three spacings to determine the optimum soils and spacing needed to maximize biomass production.

Other scientific investigators for the project are Ron Smith and Stewart Cameron, Canadian Forest Service (CFS)-Atlantic Forestry Centre in Fredericton, who will provide yew propagation expertise, help with plantation establishment, and provide methods for paclitaxel analysis, and Mamdouh Abou-Zaid, CFS-Great Lakes Forestry Centre in Sault St. Marie, who will perform the paclitaxel analyses and help screen and select elite paclitaxel-producing plants.

Other MNR staff involved include OFRI's Denny Irving and Maara Packalen, who will help establish the plantation at the OFRI Arboretum (Packalen will also help with labwork), and Forest Health and Silviculture Section's Mike Irvine, who will conduct weed control trials on the Arboretum-grown yew. Other project partners include the Upper Lakes Environmental Research Network (ULERN), Sault Ste. Marie, and Bioxel Pharma, a biopharmaceutical company in Sainte-Foy, QC.

For more information, contact Tom Noland at OFRI, (705)946-7421, tom.noland@mnr.gov.on.ca.

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All you have to do to get on this e-mailing list is send your name, job title, and e-mail address to abigail.obenchain@mnr.gov.on.ca. We promise we will not share your contact information.

Ravi Kanipayor is OFRI's new chemistry lab group leader. He has a master's degree in chemistry from Brock University and has held a number of technical, supervisory and senior management positions with private-sector labs. In addition, he has been designated a technical auditor with the Standards Council of Canada for laboratory accreditation and ISO certification and has taught fourth-year chemistry at Ryerson Polytechnical University in Toronto. His duties at OFRI include working with research scientists to direct the planning, development, coordination, and operation of OFRI's geochemistry and biochemistry labs; developing and maintaining quality assurance/quality control standards and protocols; and designing laboratory testing methods. He will also be involved in establishing a laboratory for developing innovative, portable technologies to support scientific activities at OFRI.

OFRI's Forest Landscape Ecology Program has two new staff:

· **Junlin Zhao** is the new landscape ecology geographic information systems (GIS) analyst. He has a PhD in geographic information systems from the Institute of Geography at the Chinese Academy of Sciences in Beijing. Before joining OFRI, he taught GIS at the University of Toronto.

· **Marc Ouellette**, a Sault College computer technology and programming graduate, is the acting landscape ecology systems analyst.

Both are involved in research and training on the BFOLDS model (see related article in this issue) in support of the development of MNR's new landscape guide as well as other landscape-level forest policy and research initiatives.

Forest ecology and stand management research scientist **Blake MacDonald** retired in January 2004. He worked for MNR for 28 years, including stints as a research assistant in Maple, a project forester in Whitney, and a research scientist in Thunder Bay and at OFRI. Highlights of his tenure include helping to develop the first boreal mixedwood management guide for the province, breaking new ground by applying active adaptive management to forestry issues in collaboration with a broad partnership in northeastern Ontario, developing indices of vegetative competition suitable for complex mixedwood stands, and clarifying the potential and limitations of partial cutting on boreal mixedwood sites. He says he has appreciated the

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OFRI STAFF NEWS

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positive response of MNR staff to new resource management information that he has transferred in workshops, field tours, and demonstration areas and has greatly enjoyed the rugged diversity of Ontario's landscape and the support and comradeship of MNR colleagues from Algonquin Park to Dryden. He has relocated to southern Vancouver Island to pursue teaching and consulting opportunities and to spend as much time as possible hiking, camping, cycling, and kayaking.

Modelling research scientist **Changhui Peng** has left OFRI to take on a new challenge: the prestigious Canada Research Chair in Environment Modelling at the Université du Québec à Montréal. His contributions to sustainable forest management in Ontario include modelling forest growth and yield dynamics, specifically developing non-linear height-diameter models for Ontario's boreal species; providing a baseline estimate of carbon stocks for Ontario for 1990; and developing a hybrid growth and yield/carbon budget model called TRIPLEX and calibrating it for Canada's boreal forests.

Research pathologist **John McLaughlin** has taken a three-year educational leave to work on a PhD at the University of Guelph. He is investigating the causes of red pine decline in Ontario and the possible role of climate change (e.g., drought) in that decline. He says, "In recent years, unprecedented rates of red pine mortality have been observed in Ontario, disrupting red pine management and causing significant financial losses."

Landscape modelling research scientist **Jean-Noël Candau** has taken a one-year sabbatical leave to return to his native France to work for the Unité de Recherches Forestières Méditerranéennes (part of the Institut National de la Recherche Agronomique), located in Avignon.

Genetics data analyst **Marilyn Cherry** left OFRI to become assistant director of the Pacific Northwest Tree Improvement Research Cooperative at Oregon State University in Corvallis.

Upcoming events

May: ***The Science of Vegetation Management.*** Information sessions for MNR district and industry staff in Ontario. Register for the session closest to you: May 12-13 in Mattawa - contact Jen Girard, (705)744-1715, ext. 595, jen@canadianecology.ca; May 19-20 in Thunder Bay - contact Karen Punpur, (807)939-3106, karen.punpur@mnr.gov.on.ca; May 26-27 in Timmins - contact Jen Girard. For program information, contact Michael Irvine, (705)945-5724, michael.irvine@mnr.gov.on.ca.

June 8-11: ***45th Northeast Forest Pathology Workshop and the 53rd North Central Forest Pest Workshop.*** Niagara Falls, ON. Contacts: Richard Wilson, Ministry of Natural Resources, (705)541-5106, richard.wilson@mnr.gov.on.ca, or Anthony Hopkin, Canadian Forest Service, (705)541-5612, ahopkin@NRCan.gc.ca, http://www.glfc.cfs.nrcan.gc.ca/foresthealth/index_e.html.

October 3-6: ***Canadian Institute of Forestry and Society of American Foresters 2004 Joint Annual General Meeting and Convention - One Forest Under Two Flags.*** Edmonton, AB. Contact: Teresa Stokes, (780)422-5203, teresa.stokes@gov.ab.ca, http://www.cif-ifc.org.

50808
(1.7k P.R., 04 03 31)
ISSN 1710-9825

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We want to hear from you!

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